

Proposed Structure and Syllabus

of

Zoology

for

B.Sc. Undergraduate Programme

1st to 3rd year w.e.f. 2019-20 onwards
&

2nd & 3rd year for the students admitted
in academic session 2018-19.

Based on:

U.G.C. Choice Based Credit System (CBCS)
Model Curriculum



07/6/19

The consolidated scheme and syllabi of Three Years of Zoology in B.Sc. w.e.f. 2019-20 is as under:

Semester-I

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 101 L	Core Course-I (Zoology)	Animal Diversity I	2	2	80	20	100
ZOO- 102 L	Core Course-II (Zoology)	Animal Diversity II	2	2	80	20	100
ZOO - 103 P	Core Course-III (Zoology Practical)	Laboratory Practicals of Animal Diversity I & II	2	4	50	-	50

- The practical examination to be conducted annually with Second semester examination.

Semester-II

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 201 L	Core Course-IV (Zoology)	Comparative Anatomy and Developmental Biology of Vertebrates I	2	2	80	20	100
ZOO- 202 L	Core Course-V (Zoology)	Comparative Anatomy and Developmental Biology of Vertebrates II	2	2	80	20	100
ZOO- 203 P	Core Course-VI (Zoology Practical)	Laboratory Practicals of Comparative Anatomy and Developmental Biology of Vertebrates I & II	2	4	50	-	50

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Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 301 L	Core Course-VII (Zoology)	Physiology and Biochemistry I	2	2	80	20	100
ZOO- 302 L	Core Course-VIII (Zoology)	Physiology and Biochemistry II	2	2	80	20	100
ZOO- 303 P	Core Course-IX (Zoology Practical)	Laboratory Practicals of Physiology and Biochemistry I & II	2	4	50	-	50

- The practical examination to be conducted annually with Fourth semester examination.

Semester-IV

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 401 L	Core Course-X (Zoology)	Genetics and Evolutionary Biology I	2	2	80	20	100
ZOO- 402 L	Core Course-XI (Zoology)	Genetics and Evolutionary Biology II	2	2	80	20	100
ZOO- 404 L Or ZOO- 405 L or ZOO- 406 L or ZOO- 407 L	Skill Enhancement Course-I (Zoology)	Apiculture or Aquarium Fish Keeping or Medical Diagnostics or Sericulture	2	2	80	20	100
ZOO- 403 P	Core Course-XII (Zoology Practical)	Laboratory Practicals of Genetics and Evolutionary Biology I & II	2	4	50	-	50

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Semester-V

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 501 L Or ZOO- 504 L	Discipline Specific Elective Course-I (Zoology)	Applied Zoology I Or Aquatic Biology I	2	2	80	20	100
ZOO- 502 L Or ZOO- 505 L	Discipline Specific Elective Course-II (Zoology)	Applied Zoology II Or Aquatic Biology II	2	2	80	20	100
ZOO - 503 P Or ZOO- 506 P	Discipline Specific Course-III (Zoology Practical)	Laboratory Practicals of Applied Zoology I & II Or Aquatic Biology I & II	2	4	50	-	50

- The practical examination to be conducted annually with Sixth semester examination.

Semester-VI

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
ZOO- 601 L Or ZOO- 604 L	Discipline Specific Elective Course-IV (Zoology)	Reproductive Biology I Or Insect, Vector and Diseases I	2	2	80	20	100
ZOO- 602 L Or ZOO- 605 L	Discipline Specific Elective Course-V (Zoology)	Reproductive Biology II Or Insect, Vector and Diseases II	2	2	80	20	100
ZOO- 603 P Or ZOO- 606 P	Discipline Specific Elective Course-VI (Zoology Practical)	Laboratory Practicals of Reproductive Biology I & II Or Insect, Vector and Diseases I & II	2	4	50	-	50



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Semester I
Core Course: I (Zoology)
ZOO 101 L Animal Diversity I

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit -1

General characters and classification up to classes of Kingdom Protista and Phylum (**Porifera**); Locomotory Organelles and locomotion in Protozoa, Canal system in *Sycon*

Unit-2

General characters and classification up to classes of Phylum (**Cnidaria, Platyhelminthes**) Polymorphism in Hydrozoa, Life history of *Taenia solium*

Unit-3

General characters and classification up to classes of Phylum (**Nemathelminthes, Annelida**); *Ascaris lumbricoides* with its parasitic adaptations, Metamerism in Annelida,

Unit-4

General characters and classification up to classes of Phylum (**Arthropoda, Mollusca**); Metamerism in Annelida, Vision in Arthropoda, Metamorphosis in Insects, Torsion in gastropods

Reference Books:

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

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Semester I
Core Course: II (Zoology)
ZOO 102 L Animal Diversity II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-1

General characters and classification up to classes of Phylum (**Echinodermata, Protochordates**)
Water-vascular system in Asteroidea, Phylogeny of Protochordata

Unit-2

General characters and classification up to classes of Phylum (**Agnatha, Pisces**); Metamerism in Annelida, Agnatha, cyclostomes Osmoregulation in Fishes,

Unit-3

General characters and classification up to classes of Phylum (**Amphibia, Reptiles**); Parental care (up to order), Poisonous and non-poisonous snakes, Biting mechanism in snakes

Unit -4

General features and Classification up to orders of Phylum (**Aves, Mammals**); Flight adaptations in birds and Origin of mammals

Reference Books:

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

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Semester I
Core Course: III (Zoology Practical)
ZOO 103 P Laboratory Practicals of Animal Diversity I & II

Credits (0-2)
Maximum Marks: 50
Internal Marks: 0
External Marks: 50

1. Study of the following specimens:

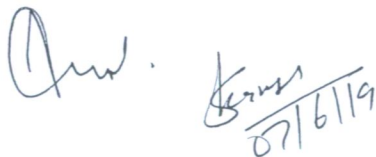
Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

2. Study of the following permanent slides:

T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. Key for Identification of poisonous and non-poisonous snakes

An "animal album" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.


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Semester II
Core Course: IV (Zoology)
ZOO 201 L Comparative Anatomy and Developmental Biology of Vertebrates I

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit -1

Derivatives of integument w.r.t. glands and digital tips, Evolution of visceral arches

Unit -2

Brief account of alimentary canal and digestive glands, Gills, lungs, air sacs and swim bladder

Unit -3



Evolution of heart and aortic arches, Succession of kidney, Evolution of urinogenital ducts

Unit -4

Comparative account of brain, Types of receptors

Reference Books:

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.

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Semester II
Core Course: V (Zoology)
ZOO 202 L Comparative Anatomy and Developmental Biology of Vertebrates II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit -I

Introduction and scope of development briefly Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes

Unit -2

Cleavage and patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo, Implantation of embryo in humans

Unit -3


Formation of human placenta and functions, other types of placenta on the basis of histology

Unit -4

Metamorphic events in frog life cycle and its hormonal regulation, Fundamental processes in development (brief idea)-Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death

Reference Books:

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.


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Semester II

Core Course: VI (Zoology Practical)

ZOO 203 P Laboratory Practicals of Comparative Anatomy and Developmental Biology of Vertebrates I & II

Credits (0-2)

Maximum Marks: 50

Internal Marks: 0

External Marks: 50

1. Osteology:

- a) Disarticulated skeleton of fowl and rabbit
- b) Carapace and plastron of turtle /tortoise
- c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.

3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.

4. Study of placental development in humans by ultrasound scans.

5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

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Semester III
Core Course: VII (Zoology)
ZOO 301 L Physiology and Biochemistry I

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

Unit-II

Physiology of digestion in the alimentary canal, Absorption of carbohydrates, proteins, lipids. Pulmonary ventilation, Respiratory volumes and capacities

Unit-III

Transport of Oxygen and carbon dioxide in blood. Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

Unit-IV

Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the Cardiac Impulse, Cardiac cycle

Reference Books

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.


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Semester III
Core Course: VIII (Zoology)
ZOO 302 L Physiology and Biochemistry II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle, Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

Unit-II

Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

Unit-III

Biosynthesis and β oxidation of palmitic acid, Transamination, Deamination and Urea Cycle

Unit-IV

Introduction, Mechanism of Action, Enzyme Kinetics, Inhibition and Regulation

Reference Books

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.


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Semester III
Core Course: IX (Zoology Practical)
ZOO 303 P Laboratory Practicals of Physiology and Biochemistry I & II

Credits (0-2)
Maximum Marks: 50
Internal Marks: 0
External Marks: 50

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose and Lactose).
5. Estimation of total protein in given solutions by Lowry's method.
6. Study of activity of salivary amylase under optimum conditions

 
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Semester IV
Core Course: X (Zoology)
ZOO 401 L Genetics and Evolutionary Biology I

Credits (2-0)
Maximum Marks::100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance

Unit-II

Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence

Unit-III


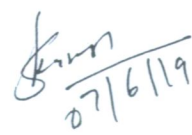
Somatic cell genetics - an alternative approach to gene mapping, Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy

Unit-IV

Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Chromosomal mechanisms, dosage compensation

Reference Books

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.

 
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- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

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Semester IV
Core Course: XI (Zoology)
ZOO 402 L Genetics and Evolutionary Biology II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Major Events in History of Life, Lamarckism, Darwinism, Neo-Darwinism

Unit-II

Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse, Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive)

Unit-III

Artificial selection, Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

Unit-IV

Macro-evolutionary Principles (example: Darwin's Finches) Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

Reference Books

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.


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- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

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Semester IV
Core Course: XII (Zoology Practical)
ZOO 403 P Laboratory Practicals of Genetics and Evolutionary Biology I & II

Credits (0-2)
Maximum Marks: 50
Internal Marks: 0
External Marks: 50

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
 - a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
 - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

 
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Semester – IV
Skill Enhancement Course –I (Zoology)
ZOO 404 L Apiculture

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks

Unit-1

History, Classification and Biology of Honey Bees Social Organization of Bee Colony Artificial Bee rearing (Apiary),

Unit-2

Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Methods of Extraction of Honey (Indigenous and Modern)

Unit-3

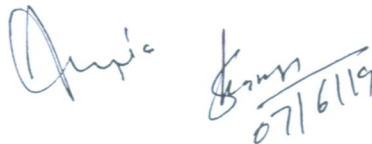
Bee Diseases and Enemies Control and Preventive measures

Unit-4

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

Reference Books

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S., *Beekeeping in India*, Indian council of Agricultural Research, NewDelhi.

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Semester – IV
Skill Enhancement Course –I (Zoology)
ZOO 405 L Aquarium Fish Keeping

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks

Unit-1

Introduction to Aquarium Fish Keeping the potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit-2

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

Unit -3

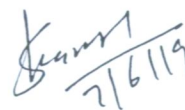
Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit-4

Live fish transport - Fish handling, packing and forwarding techniques. General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

Reference Books

1. George Hadwin, *Aquarium fish keeping*, Random Publications.
2. Mary Bailey, *Aquarium and Aquarium fish*, Lorenz Books Publications.
3. HS Jagtap, *A textbook of Pisciculture and aquarium keeping*, Astral International Pvt. Ltd. Delhi.
4. Charles Nash Page, *Aquaria: A Treatise on the foods, breeding and care of fancy Gold Fish, Anemone Fish etc.* by: Sagwan Press



Semester – IV
Skill Enhancement Course –I (Zoology)
ZOO 406 L Medical Diagnostics

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks

Unit-1

Introduction to Medical Diagnostics and its Importance Urine Analysis: Physical characteristics; Abnormal constituents

Unit-II

Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Unit-III

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

Unit-IV

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

Reference Books

- Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers
- Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II Edition, Bhalani Publishing House
- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
- Guyton A.C. and Hall J.E. *Textbook of Medical Physiology*, Saunders
- Robbins and Cortan, *Pathologic Basis of Disease*, VIII Edition, Saunders
- Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.


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Semester – IV
Skill Enhancement Course –I (Zoology)
ZOO 407 L Sericulture

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks

Unit-1

Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture Life cycle of *Bombyx mori*

Unit-II

Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO

Unit-III

Silkworm rearing technology: Early age and Late age rearing, Types of mountages, Spinning, Harvesting and storage of cocoons

Unit-IV

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates, Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Reference Books

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.


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Semester – V
Discipline Specific Elective Course -1 (Zoology)
ZOO 501 L Applied Zoology I

Credits (2-0)
Maximum Marks:100
Internal Marks:20
External Marks:80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis Transmission, Prevention and control of diseases: Tuberculosis, typhoid

Unit-II

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

Unit-III


Life history and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*

Unit-IV

Life history and pathogenicity of *Ancylostoma duodenale* and *Wuchereria bancrofti*

Reference Books

- Park, K. (2007). *Preventive and Social Medicine*. XVI Edition. B.B Publishers.
- Arora, D. R and Arora, B. (2001). *Medical Parasitology*. II Edition. CBS Publications and Distrib
- Kumar and Corton. *Pathological Basis of Diseases*.
- Atwal, A.S. (1986). *Agricultural Pests of India and South East Asia*, Kalyani Publishers.
- Dennis, H. (2009). *Agricultural Entomology*. Timber Press (OR).
- Hafez, E. S. E. (1962). *Reproduction in Farm Animals*. Lea & Fabiger Publisher
- Dunham R.A. (2004). *Aquaculture and Fisheries Biotechnology Genetic Approaches*.
- CABI publications, U.K.
- Pedigo, L.P. (2002). *Entomology and Pest Management*, Prentice Hall.


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Semester – V
Discipline Specific Elective Course -II (Zoology)
ZOO 502 L Applied Zoology II

Credit (2-0)
Maximum Marks:100
Internal Marks:20
External Marks:80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-1

Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*

Unit-II

Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

Unit-III

Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs

Unit-IV

Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

Reference Books

- Park, K. (2007). *Preventive and Social Medicine*. XVI Edition. B.B Publishers.
- Arora, D. R and Arora, B. (2001). *Medical Parasitology*. II Edition. CBS Publications and Distributors.
- Kumar and Corton. *Pathological Basis of Diseases*.
- Atwal, A.S. (1986). *Agricultural Pests of India and South East Asia*, Kalyani Publishers.
- Dennis, H. (2009). *Agricultural Entomology*. Timber Press (OR).
- Hafez, E. S. E. (1962). *Reproduction in Farm Animals*. Lea & Fabiger Publisher

 
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- Dunham R.A. (2004). *Aquaculture and Fisheries Biotechnology Genetic Approaches*. CABI publications, U.K.
- Pedigo, L.P. (2002). *Entomology and Pest Management*, Prentice Hall.

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Semester – V

Discipline Specific Elective Course -III (Zoology)
ZOO 503 P Laboratory Practicals of Applied Zoology I & II

Credits (0-2)

Maximum Marks:50

Internal Marks: 0

External Marks:50

1. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium

Prof. J. S. Kumar
27/6/19

Semester – V
Discipline Specific Elective Course -1 (Zoology)
ZOO 504 L Aquatic Biology I

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Brief Introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers)

Unit-II

Estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

Unit-III

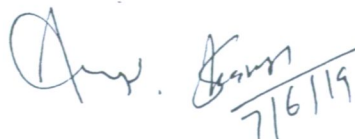
Origin and classification of lakes, lakes as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.

Unit-IV

Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes

Reference Books

- Anathakrishnan : *Bioresources Ecology* 3rd Edition
- Goldman : *Limnology*, 2nd Edition
- Odum and Barrett : *Fundamentals of Ecology*, 5th Edition
- Pawlowski : *Physicochemical Methods for Water and Wastewater Treatment*, 1st Edition
- Wetzel : *Limnology*, 3rd edition
- Trivedi and Goyal : *Chemical and biological methods for water pollution studies*
- Welch : *Limnology Vols. I-II*


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Semester – V
Discipline Specific Elective Course -II (Zoology)
ZOO 505 L Aquatic Biology II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Brief introduction of the marine biomes, Salinity and density of Sea water, Continental shelf.

Unit-II

Adaptations of deep sea organisms, coral reefs, sea weeds.

Unit-III

Brief introduction of different types of pollution, Control of pollution causes of pollution: Causes and control of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills.

Unit-IV

Eutrophication, Management and conservation (legislations), Sewage treatment, Water quality assessment- BOD and COD.

Reference Books

- Anathakrishnan : *Bioresources Ecology* 3rd Edition
- Goldman : *Limnology*, 2nd Edition
- Odum and Barrett : *Fundamentals of Ecology*, 5th Edition
- Pawlowski : *Physicochemical Methods for Water and Wastewater Treatment*, 1st Edition
- Wetzel : *Limnology*, 3rd edition
- Trivedi and Goyal : *Chemical and biological methods for water pollution studies*
- Welch : *Limnology Vols. I-II*

Dr. S. S. S. S.
07/6/19

Semester – V
Discipline Specific Elective Course -III (Zoology)
ZOO 506 P Laboratory Practicals of Aquatic Biology I & II

Credits (0-2)
Maximum Marks: 50
Internal Marks: 0
External Marks: 50

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant/Marine bio-reserve/Fisheries Institutes.

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Semester – VI
Discipline Specific Elective Course -IV (Zoology)
ZOO 601 L Reproductive Biology I

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female.

Unit-II

Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit-III

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, stem cell renewal.

Unit-IV

Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract.

Reference Books

- Austin, C.R. and Short, R.V.: *Reproduction in Mammals*. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds): *Endocrinology*. W.B. Saunders and Company.
- Knobil, E. et al. (eds): *The Physiology of Reproduction*. Raven Press Ltd.
- Hatcher, R.A. et al : *The Essentials of Contraceptive Technology*. Population Information Programme.

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Semester – VI
Discipline Specific Elective Course -V (Zoology)
ZOO 602 L Reproductive Biology II

Credits (2-0)
Maximum Marks: 100
Internal Marks: 20
External Marks: 80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones.

Unit-II

Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit-III

Infertility in male and female: causes, diagnosis and management.

Unit-IV

Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

Reference Books

- Austin, C.R. and Short, R.V.: *Reproduction in Mammals*. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds): *Endocrinology*. W.B. Saunders and Company.
- Knobil, E. et al. (eds): *The Physiology of Reproduction*. Raven Press Ltd.
- Hatcher, R.A. et al : *The Essentials of Contraceptive Technology*. Population Information Programme.

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Semester – VI
Discipline Specific Elective Course -VI (Zoology)
ZOO 603 P Laboratory Practicals of Reproductive Biology I & II

Credits (0-2)
Maximum Marks: 50
Internal Marks: 0
External Marks: 50

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovaryectomy, hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices

Dr. J. J. J.
07/6/19

Semester – VI
Discipline Specific Elective Course -IV (Zoology)
ZOO 604 L Insect, Vectors and Diseases I

Credits (2-0)
Maximum Marks:100
Internal Marks:20
External Marks:80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeling habits.

Unit-II

Brief introduction of Carrier and vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit-III



Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit-IV

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes

Reference Books

- Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
- Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication
- Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell

 
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Semester – VI
Discipline Specific Elective Course -V (Zoology)
ZOO 605 L Insect, Vectors and Diseases II

Credits (2-0)
Maximum Marks:100
Internal Marks:20
External Marks:80

Note:

Nine questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit and the compulsory question. Each question will be of 16 marks.

Unit-I

Study of sand fly-borne diseases- Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever, Control of Sand fly. Study of house fly as important mechanical vector, Myiasis, Control of house fly.

Unit-II

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit-III



Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

Unit-IV

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

Reference Books

- Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
- Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication
- Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell

 
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Semester – VI
Discipline Specific Elective Course -VI (Zoology Practical)
ZOO 606 P Laboratory Practicals of Insect, Vectors and Diseases I & II

Credits (0-2)
Maximum Marks:50
Internal Marks: 0
External Marks: 50

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: *Aedes*, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica*, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

Ans
27/6/19